
EXHIBIT 5

**IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION**

THE TRUSTEES OF
PURDUE UNIVERSITY,

Plaintiff,

v.

STMICROELECTRONICS INTERNATIONAL
N.V. and STMICROELECTRONICS, INC.,

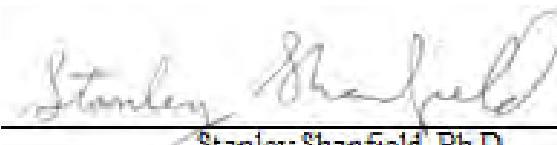
Defendants.

v

Civil Action No. 6:21-cv-00727-ADA

JURY TRIAL DEMAND

**REBUTTAL EXPERT REPORT OF DR. STANLEY SHANFIELD REGARDING
U.S. PATENT NO. 7,498,633**


Stanley Shanfield
Stanley Shanfield, Ph.D.
July 14, 2023

in fabricating these devices.

78. Third, the applicants' statement is not inconsistent with statements in Dr. Cooper's lab notebook. Dr. Lipkin ignores a key portion of the very passage she cites:

Wide bandgap semiconductors such as silicon carbide offer the opportunity to move power electronics beyond the boundaries set by the material limits of silicon. SiC is especially attractive because of its similarities to silicon, especially its native oxide SiO₂. *In developing new power electronics in SiC, it is natural to begin by borrowing existing device structures from the silicon world. However, the very properties that make SiC attractive (e.g. high critical field, extreme thermal stability) also present new challenges that force us to abandon a strict imitation of silicon."*

Lipkin Report. ¶ 245. (emphasis added). Therefore, while a POSITA *may* have looked to silicon structures, the use of segmented base contacts in a linear stripe design for SiC would not have been obvious due to the fundamental differences in SiC and silicon device, such as resistance components and electric fields, as detailed in the applicants' response.⁴

VII. PRIORITY

79. As previously mentioned, the '633 Patent claims priority to and incorporates by reference the '152 Provisional, entitled "Optimized Vertical Power DMOSFETs in Silicon Carbide" and filed on January 21, 2005. '633 Patent at 1:4-8.

80. In preparing the opinions and discussion outlined in this report, I reviewed the '152 Provisional, which provides that conception occurred January-April 2004 and reduction to practice occurred on April 26, 2004. *See* PU00000004.

81. The '152 Provisional further refers to, as the *detailed description of the invention*, pages 51-52 of patent notebook (attached to the '152 Provisional and dated April 26, 2004) and PhD Thesis Proposal of Asmita Saha, School of Electrical and Computer Engineering, July 17, 2004 (the "Saha Thesis Proposal"). PU00000005; *see also* PU00000009 ("These ideas are further detailed, and a detailed design optimization study is presented in the PhD proposal currently being written by A. Saha."). Based on the disclosures in the '152 Provisional, I considered both the

⁴ I understand that ST and Dr. Lipkin may cite these statements as inconsistent with statements made to the U.S. Patent and Trademark Office ("USPTO") during prosecution of the '633 Patent in attempting to prove inequitable conduct. While I offer no opinion on that issue, my opinion is that the statements in Dr. Cooper's lab notebook (and elsewhere) regarding the incompatibility of silicon techniques and structures with that of SiC are accurate or consistent with arguments made during prosecution.

notebook pages and the Saha Thesis Proposal as part of the '152 Provisional, and I reviewed both for my analysis and opinions. However, I note that the Lipkin Report does not address or mention the Saha Thesis Proposal.

82. I understand that Dr. Lipkin contends the '152 Provisional discloses "neither the JFET width nor spaced apart base contact limitations" and thus, the Asserted Claims of the '633 Patent "have a priority date of January 23, 2006." Lipkin Report ¶ 212.

83. I also understand that Purdue contends the earliest date of invention for the Asserted Claims is February 2004. *See* Plaintiff's Amended Supplemental Disclosure of Earliest Date of Invention, which was served on February 18, 2023. I understand that this date is based on the metadata for the documents evidencing conception and reduction to practice that Purdue produced in this case, which include: PU00000001-9 (the '152 Provisional); PU00000010-11 (the '633 Patent); PU00000018-87 (Saha Thesis Proposal); PU00007057-7065 (Chapter 1 of Saha Thesis Proposal, created February 29, 2004 and last modified March 27, 2004); PU00006987-6999 (Chapter 2 of Saha Thesis Proposal, created and last modified February 26, 2004); PU00006956-6986 (Chapter 3 of Saha Thesis Proposal, created February 7, 2004 and last modified February 26, 2004); PU00007066-7076 (Chapter 4 of Saha Thesis Proposal, dated March 27, 2004); PU00007178-7183 (Chapter 5 of Saha Thesis Proposal, created February 29, 2004 and last modified March 27, 2004); and PU00023404-23592 (Dr. Saha's thesis, submitted on December 2006). *Id.* at 1.

84. For the following reasons, I agree with Purdue and in my opinion, the Asserted Claims of the '633 Patent have a priority date of no later than February 29, 2004.

85. First, I understand from the Expert Report of Greg Jackson that based on the metadata, chapters 1-5 of the Saha Thesis Proposal were created on the dates provided above and that the metadata provided is reliable.

86. Second, during his deposition, Dr. Cooper confirmed that the Saha Thesis Proposal existed as early as February 2004.

Q. Okay. If you can go on to the next page, please. It says, Roman IV, "Detailed Description of the Invention. Do you see that?"

A. Yes.

Q. And there's a reference there to the Ph.D. thesis proposal of Dr. Saha, and there's a July 17, 2004, date, correct?

A. That's correct.

Q. To your knowledge, did the thesis proposal of Dr. Saha exist before July

17, 2004?

A. It did.

Q. When is the earliest date, to your knowledge, that the thesis proposal existed?

A. I believe it's – it's in February of 2004.

Q. And what is that -- what is that based on?

A. It's based on a copy of -- of an earlier draft that is on my computer, with a metadata creation date of February 2004.

Cooper Dep. Tr. at 307:1-15.

87. Third, during her deposition, Dr. Saha (one of the named inventors of the '633 Patent) confirmed that the '152 Provisional relates to and was based on her PhD thesis. Saha Dep. Tr. 59:3-14 ("[A]ll these things are from Ph.D. thesis, from my research work."); *id.* at 59:21-22. She also testified that in April 2004, evidence concerning the claimed invention that led to the filing of the '152 Provisional included "simulation results, like, fabrication data," "the wafers, actual wafers, where the devices were fabricated," and "the lab notebook, that's where all the fabrication steps are written." *Id.* at 65:19-66:7. The simulation results and fabrication details were included in the Saha Thesis Proposal. *See, e.g.*, PU00006956-6986.

88. In her deposition, Dr. Saha also articulated three unique features of the device structure disclosed in the '152 Provisional, compared to earlier work—***two of which are key elements of the Asserted Claims:***

So one is the narrow JFET, the maximum -- or, sorry, the minimum JFET width, what we used on the previous version was 4 micron. So here the JFET is less than 3 micron. Actually, the optimized one has 1-micron JFET width. Definitely, we had to optimize the doping to get the lowest possible Ron resistance as well as maximum VBD. So that's one.

Since the JFET is narrow, the current path is constricted. We need to have a high doping or low-resistance layer to help the current path spread over the entire drift region so that the effective area increases and Ron lowers. That's the – that's the current-spreading layer. You can tell it's part of the drift layer, and, like, just with a higher doping concentration.

...

We had a segmented p-base that also helped to reduce the -- reduce the Ron resistance and, actually, help to improve the tolerance -- to the lithography. So these are the primary three factors.

Id. at 73:5-74:9.

89. Fourth, based on my review of the five chapters (*i.e.*, the documents bates labeled PU00007057-7065, PU00006987-6999, PU00006956-6986, PU00007066-7076, and PU00007178-7183), I find chapter 3 (PU00006956-6986), which was created February 7, 2004

and last modified February 26, 2004, to be of particular interest since it discloses the two limitations of Claim 9 that Dr. Lipkin contends are not disclosed in the '152 Provisional: the JFET width and segmented base contact. *See Lipkin Report ¶ 212.* As shown below, the Saha Thesis Proposal does disclose the claimed JFET widths (“less than about three micrometers” and “about one micrometer”).

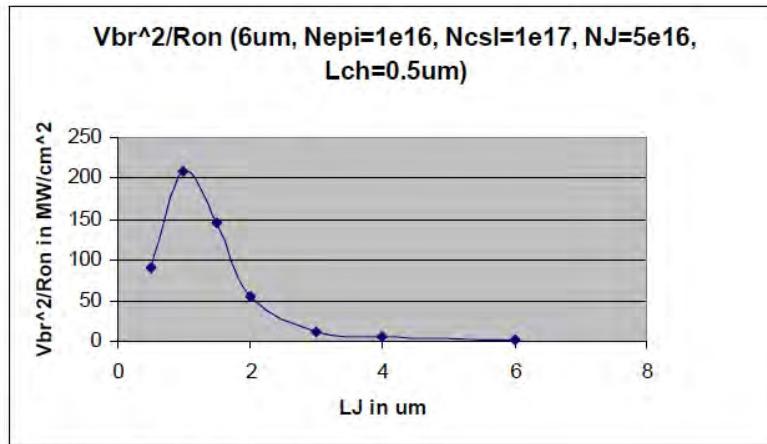
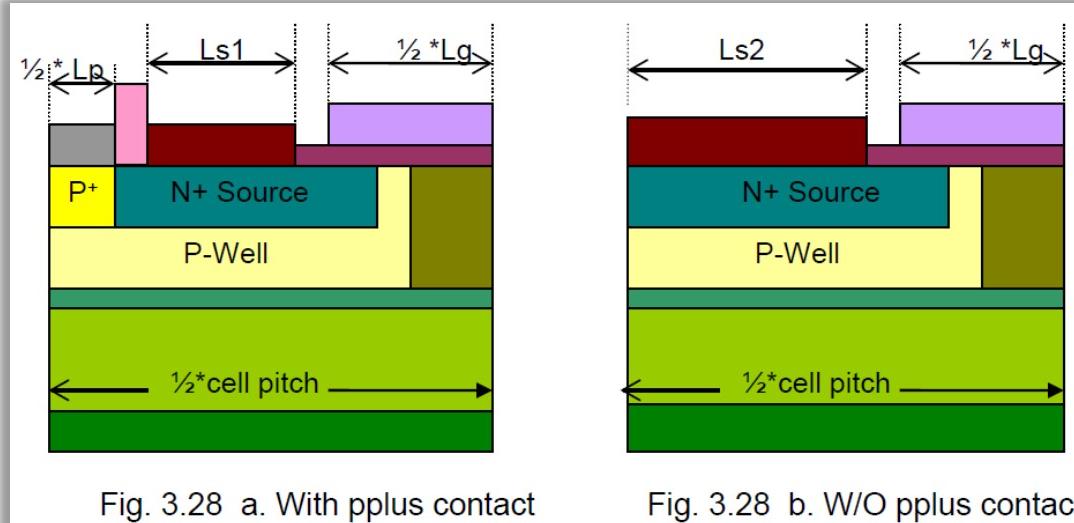


Fig. 3.7 Variation of V_{br}^2/R_{on} with JFET Length

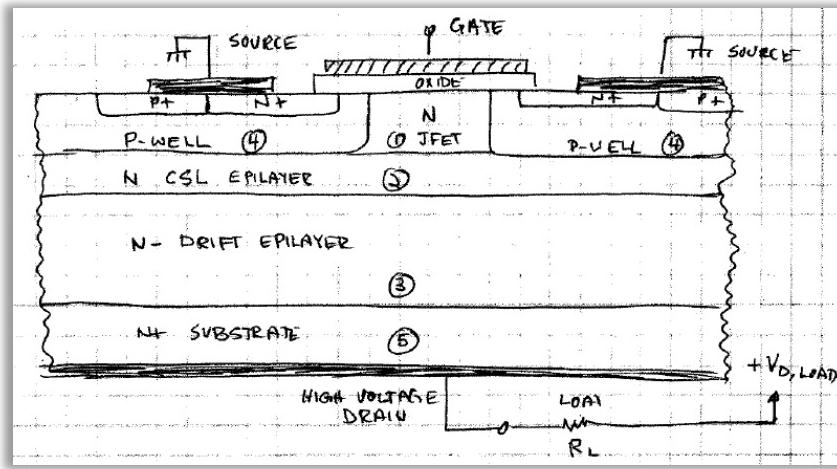
PU00006967 (determining one micrometer as the “optimum”) (document created on February 7, 2004, and modified on February 26, 2004, based on the metadata); *see also PU00006957 (“JFET Length: This is a very important parameter in our design study.”).*

90. The Saha Thesis Proposal also discloses the claimed segmented base contacts. *See e.g., PU00006984:*

As we have discussed earlier (in chap 2), the misalignment between pplus and source contact introduces significant amount of resistance. So in our new design, instead of having continuous pplus contact, we will have small islands of them. So for some region of the device, the cross-section will look like fig 3.28 (a) where we will have pplus contact. But for the other parts, there will be no pplus contact and the source contact will be continuous like fig 3.28 (b).



91. Lastly, the '152 Provisional and the Saha Thesis Proposal disclose the other limitations of Claim 9 that are not addressed in the Lipkin Report. For example, the Saha Thesis Proposal states: "In this thesis, our discussion will be centered on SiC power DMOS (Double Implanted MOS) structures." PU00007059. And as shown below, the '152 Provisional includes the structure of the SiC MOSFET:



PU00000008.

VIII. VALIDITY OF THE '633 PATENT IN VIEW OF THE ALLEGED PRIOR ART

92. As an initial matter, this Report does not address any alleged prior art that is not substantively analyzed in the Lipkin Report, *i.e.*, it is limited to the references specifically discussed in Sections IX and XI of the Lipkin Report, as detailed below. I understand that ST has the burden to demonstrate invalidity by clear and convincing evidence. If ST and Dr. Lipkin are